

Institution: De Montfort University		
Unit of Assessment: 4		
Title of case study: Interactive Learning Resources and Behavioural Training to Improve Young Children's Knowledge of Microorganisms and Handwashing Skills Globally		
Period when the underpinning research was undertaken: 2016–present		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Dr Katie Laird	Associate Professor in Microbiology	September 2009–present
Prof. Sarah Younie	Professor of Education Innovation	October 1995–present
Dr Anuenue Baker-Kukona	Associate Professor in Quantitative Methods	July 2014–Present
Dr Iain Williamson	Associate Professor	Jan 2005–Present
Dr Marie-Josée Bisson	VC2020 Senior Lecturer	Jan 2016–Present
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Period when the claimed impact occurred: 2017–present		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact Interdisciplinary research between psychology, health sciences and education has resulted in the co-creation of 'A Germ's Journey'; a resource-based intervention comprising books, web games, videos and posters. The resources are utilised globally across Africa, Asia and Europe, with 3,540 books donated to schools, museum exhibits, community centres and refugee camps. Reaching 145,432 people thus far, 'A Germ's Journey' has led to improvements in handwashing behaviour in children, enhanced knowledge of microorganism transfer in children, and reduced diarrhoea and vomiting associated with poor hygiene. Most recently, these resources have been developed in response to the Covid-19 pandemic in line with WHO guidelines stating that handwashing is the most effective strategy for prevention of infection.		
2. Underpinning research (1) CONTEXT Handwashing is among the most effective measures for preventing the spread of microorganisms, and has been critical in the response to Coronavirus. Although young children are particularly vulnerable to the spread of microorganisms, their understanding of the significance of handwashing is scant, leading to poor handwashing behaviour. While diarrhoeal diseases account for 1 in 9 child deaths globally, research shows that effective handwashing could protect 1 in 3 children from diarrhoeal sickness. Combining expertise in education, microbiology and psychology, the interdisciplinary research team at DMU began investigating the handwashing skills of young children in the UK and internationally in 2017. This led to the initial development of the co-created educational resources called 'A Germ's Journey' for young children in the UK. Securing the engagement of major international stakeholders and external and internal funding of GBP71,155 enabled culturally relevant resources to be subsequently developed for Africa, Asia and Middle East (with reach secured in each region and impact in all except the Middle East where the resources have only just been introduced). These free, interactive resources were co-created with our stakeholders / research partners: PAL International UK (disinfectant company); Thinktank UK (Children's Science Museum); ESI (Environmental Sanitation Institute, India); Manav Sadhna at the Gandhi Ashram, India (NGO); University of Makeni (UniMak) Sierra Leone; Dettol, United Arab Emirates (UAE); and VSO		

International (Voluntary Service Overseas; NGO). The underpinning research captures the development, implementation and evaluation of the interactive resources and behavioural training designed to support three- to-five-year-old children in learning about microorganisms and handwashing.

(2) SKILLS AND KNOWLEDGE GAP

The team's unique approach centres on the link between young children's handwashing skills and their knowledge of microorganisms. The team's research demonstrates gaps in both areas. Among one sample of UK schoolchildren, only 1 in 10 washed between their fingers, and only 1 in 3 linked handwashing to germs [R1]. Schoolteachers in the UK, India and Sierra Leone also expressed the need for guided resources to teach handwashing knowledge and skills effectively [R3, R4]. Building on knowledge transfer and mobilisation from research to pedagogic practice on theories of learning and behaviour change, the team created resources that support the acquisition of new behavioural skills alongside new conceptual knowledge [R5, R6].

(3) GLOBAL RESOURCES

The interactive learning resources and behavioural training, called 'A Germ's Journey', include children's books, online games, posters and parent/teacher guides. These resources focus on the abstract concept of the invisible microorganism, supporting young children's acquisition of new conceptual knowledge, and include a video and song with a step-by-step guide to handwashing, supporting the development of their behavioural skills. The resources are freely available online (germsjourney.com) and are also delivered via school and community workshops globally. Situated within a behaviour change framework, the experiential workshops target young children's skill building, knowledge, motivation and social support [R1].

The resources were co-created with local children, teachers and in-country stakeholders making them culturally relevant for use in Africa (Sierra Leone), Asia (India, across the Gujarati state and Bangladesh), Europe (UK, France, Germany, Netherlands, Poland) and the Middle East (UAE). Participating stakeholders worked across a variety of settings including schools, museum exhibits, community centres and refugee camps. The involvement of key stakeholders in the co-creation process ensured that local appropriation was successful [R3, R4].

(4) CLOSING THE GAP

The team's research demonstrates significant improvements in young children's knowledge of microorganisms and handwashing skills. Among one sample of UK schoolchildren, 20% more washed between their fingers one month after engaging with the interactive learning resources and behavioural training, and 30% more linked handwashing to germs [R1]. In addition to improving young children's knowledge of germs across 3 continents (the UK, India and West Africa) [R1, R2, R3], the effect of the intervention also extends to reducing the cases of diarrhoea and vomiting related illness in India.

3. References to the research

All references to the research were published in international peer-reviewed research journals.

- [R1] Younie, S., Mitchell, C., Bisson, M.-J., Crosby, S., Kukona, A. and Laird, K. (2020) 'Improving young children's handwashing behaviour and understanding of germs: the impact of A Germ's Journey educational resources in schools and public spaces', *PLoS ONE*, 15(11): e0242134. <https://doi.org/10.1371/journal.pone.0242134>
- [R2] Crosby, S., Laird, K. and Younie, S. (2019) 'Interactive health-hygiene education for early years: the creation and evaluation of learning resources to improve understanding of handwashing practice', *International Journal of Early Years Education*, 27(4): 374–390; <https://doi.org/10.1080/09669760.2019.1628010>
- [R3] Crosby, S., Laird, K. and Younie, S. (2019) 'Children and handwashing: developing a resource to promote health and well-being in low and middle income countries', *Health Education Journal*, 79(2): 123–137; <https://doi.org/10.1177/0017896919866227>
- [R4] Crosby, S., Younie, S., Williamson, I. and Laird, K. (2020) 'Evaluating approaches to designing effective co-created hand-hygiene interventions for children in India, Sierra

Leone and the UK', *PLoS ONE*, 15(9): e0239234; <https://doi.org/10.1371/journal.pone.0239234>

- [R5] Jones, S.-L., Procter, R. and Younie, S. (2015) 'Participatory knowledge mobilization: an emerging model for translational research in education', *Journal of Education for Teaching*, 41(5): 555–573; <https://doi.org/10.1080/02607476.2015.1105540>
- [R6] Younie, S., Audain, J., Eloff, I., Leask, M., Procter, R. and Shelton, C. (2019) 'Mobilising knowledge through global partnerships to support research-informed teaching: five models for translational research', *Journal of Education for Teaching*, 44(5): 574–589; <https://doi.org/10.1080/02607476.2018.1516348>

All funding was achieved by the co-founders of Germ's Journey (Laird and Younie).

EXTERNAL FUNDING

GBP58,155: Dettol (December 2020: GBP6,500), Barclays (December 2020: GBP7,500), PAL International (November 2017 – September 2019: GBP22,250), Next (September 2019: GBP5,000), Wederell Trust (January 2019–July 2019: GBP2,500), Crowdfunding (April 2018: GBP7,550), Society for Applied Microbiology (July 2015 – July 2017: GBP6,855).

4. Details of the impact

Following the commencement of the project in 2017 when resources were developed originally for the UK and then co-created on-the-ground with global collaborators/stakeholders for use internationally (particularly low- and middle-income countries), A Germ's Journey (GJ) has trained 300 teachers and reached 15,532 children using the resources in schools and refugee camps: 145,432 individuals have been reached overall (workshops/resources used at schools in UK, India, Sierra Leone, Thinktank Museum, Bangladesh Rohingya refugee camp; website analytics; conference delegates (practitioners)) [C1]. Alongside donating 3,540 books across 3 continents (Africa, Asia, Europe), data was collected to measure the suitability of the resources. Recent analytics have recorded that 3,000 books have also been sold to date, 340 e-books have been downloaded [C8] and the GJ website has been used across 117 countries in Africa, the Americas, Asia, Australia and Europe [C2].

(1) CHILDREN'S KNOWLEDGE AND BEHAVIOURAL IMPROVEMENTS IN THE UK AND INDIA

Evaluative studies have demonstrated that GJ resulted in significant improvements in young children's understanding of microorganism transfer and the relationship between microorganisms and illness in the UK. For instance, workshops in the UK in 2017 reported that 80–100% of parents/teachers (with 265 Early Years' children and 24 teachers) found the resources successful in improving children's knowledge, with teachers further reporting an increased understanding in their pupils since participating [C9 p.18-19]. As a direct result of GJ workshops with a further 225 Early Years Foundation Stage (EYFS) children in East Midlands schools in December 2019–March 2020, a 40% increase in children's germ transfer knowledge was reported immediately after the intervention. The improved knowledge was sustained over a period of up to a month (30% increase) [C1].

Within the UK, culturally relevant handwashing posters, a handwashing video-song and an interactive germ game was co-created with Thinktank Museum. Following the design of a new exhibit / interactive gallery (MiniBum: a mini city, where children under 8 years explore STEM principles through play), Thinktank has stated that since specifically redesigning the gallery and toilets to permanently feature the GJ resources to encourage handwashing, the inclusion has increased the STEM content and created a unique engagement resource. Thinktank's large footfall has ensured greater exposure to the resources (2020: x111,318 visitors). In addition, children's 'intervention workshops' held at the museum, incorporating the GJ resources, have been delivered to a total of 110 children thus far, via initial train-the-trainer workshops by the GJ team (x60), and workshops run independently by Thinktank thereafter (x50) [C4, C9].

A psychology evaluation study within Thinktank Museum demonstrated improved handwashing behaviour following the GJ intervention. After watching a handwashing video-song at Thinktank, children engaged in washing significantly more areas of their hands than those who did not see

the video, with 53% of participants washing in between fingers in the intervention group, compared to 25% in the control group, thus demonstrating the utility of the resources in a public setting of Thinktank museum [C4].

In addition, a randomised controlled trial conducted in schools, with 225 EYFS children in UK between December 2019 and March 2020, further demonstrated that the multi-component intervention was effective in instigating positive long-term behavioural changes in young children's handwashing quality, with children contacting significantly more areas of their hands during a handwashing observation immediately after the intervention compared to baseline measures. Importantly, this new skill acquisition was largely retained following a one-month delay [R1, C1].

Evaluative studies also demonstrated improvements in young children's understanding of microorganism transfer and the relationship between microorganisms and illness in India. Since September 2017, alongside NGOs, the GJ research team ran workshops with 624 children (many with low levels of literacy) and trained 216 teachers in Gujarat State (India), in areas of severe socio-economic deprivation. This increased to 5,207 children being taught as of September 2017 using GJ resources by those teachers who were initially trained by the GJ team. Furthermore, 5 school / community centre workshops in India / Ahmedabad city in 2017 using the UK resources with children aged 6–13 reported that 2 months after participating, 60–73% knew how germs can cause illness and 76–80% knew how to remove germs [C3]. A further 3 children's workshops were held in India/Ahmedabad in January 2019 for children aged 9–17 years, using the Gujarati book. This resulted in 55% of children who completed baseline and identical post-workshop assessment reporting an increased understanding, demonstrating that using the resources had a significant influence on the children's understanding.

Moreover, on follow-up with teachers in India in February 2020, 100% reported that since using the GJ resources, the children have disseminated their knowledge to their families and wider community, resulting in a reduction in children having illnesses associated with diarrhoea and vomiting within their communities [C3, C9].

(2) GJ'S EFFECT ON TEACHERS

Following the donation of 3,540 books, and teacher-trainer workshops in the UK, India and West Africa (September 2017–February 2020), 80–100% teachers stated that they are now able to teach the topic more regularly and effectively, increasing children's understanding. This has resulted in better handwashing behaviour and reduced illness in India [C3, C5, C9 pp.18-19].

To date, a total of ×6,450 books have been sold or donated globally [C8, C1].

(3) GJ'S EFFECT ON INTERNATIONAL COLLABORATORS/STAKEHOLDERS

NGOs, India

Following co-development and donation of 900 Gujarati books and resources and teacher-training, the NGOs have continued to implement the GJ intervention which has involved 200 schools and 5,207 children [C3, C8].

Sierra Leone's school curriculum

A West African version of the GJ book has been co-created with University of Makeni, and 1,000 books have been donated, to be distributed to 91 schools (7,517 children), hospitals and rural outreach clinics. The GJ team and UniMak are currently in talks with the education ministers about the implementation of the GJ resources in the school curriculum [C5, C9].

Refugee camps

A collaboration between VSO and GJ included working on the Early Childhood Care and Education in Emergencies programme, which included the use of the GJ resources for young children in the Rohingya refugee camp in Jamtoli, Bangladesh in 2018. GJ resources were used with 1,500 children and 50 volunteers. GJ resources were sent to VSO and were accessed and adapted in different languages for education in crisis settings and have been shared across 16 low-income countries [C6].

(4) RESPONSE TO COVID-19

In March 2020, free copies of the original GJ book were distributed to over 50 schools/nurseries across the Isle of Wight [C7]. Additionally, a new e-book was developed in June 2020 to teach children about handwashing in relation to respiratory viral disease. Medina Publishing made this book freely available over a limited launch period and 340 e-books were downloaded across 10 countries, with 100 print-versions being donated to schools within the East Midlands [C8, C10]. Barclays further funded the printing and donation of 1,000 books for preschools across the UK. Dettol also funded the development of a culturally relevant edition for the UAE [C8]. Data from 49 children demonstrated the book to be successful in improving children's knowledge with 88% understanding the importance of handwashing and 75% identifying sources of microorganisms directly after reading the book based on respiratory disease transmission. A sample of 6 teachers stated that they found the book helpful in teaching, noting that 'children had fun reading the books and reflected this through their play', and 59% of a sample of 32 parents stated that the book had an impact on improving awareness of microorganisms and handwashing on their children. The book also received positive reports from a parent group in Poland, with 100% stating they would buy and use the book with their children as it provides 'important knowledge for children [during] the pandemic' [C7 p.1].

5. Sources to corroborate the impact

- [C1] Infographic: Crosby, S., Laird, K. and Younie, S. (2020) A Germ's Journey: the impact of a co-created educational hand-hygiene intervention to address un sustainable development goals in education and health in the UK and low-and-middle-income-countries. East Midlands Doctoral Network (EMDoc) 2020 Conference, De Montfort University, 10 September 2020. **NB** – Infographic does not include most recent figures (as of 30/12/2020: total reach: 145,432; children reached: 15,532).
- [C2] Analytics from GJ website.
- [C3] Testimonial from Project Co-ordinator, Manav Sadhna and Environmental Sanitation Institute.
- [C4] Testimonial from Museum Manager, Thinktank Birmingham Science Museum.
- [C5] Testimonial from Vice Chancellor, University of Makeni, Sierra Leone.
- [C6] Testimonial from Lead Advisor – Education, VSO International.
- [C7] Combined PDF document of different pieces of Media Coverage (e.g. opinion piece, online newspaper articles etc).
- [C8] Testimonial from Director, Medina Publishing Ltd.
- [C9] NAACE (National Association for Education Technology) article: Younie, S., Laird, K. and Crosby, S. (2020) 'Meeting the current situation: tackling the coronavirus crisis – teaching children to protect themselves', *Advancing Education*, Spring 2020; <https://dora.dmu.ac.uk/handle/2086/19604>
- [C10] *Nursing Times* article: Laird, K., Younie, S. and Crosby, S. (2020) 'How can nurses help with teaching children more effective handwashing?', *Nursing Times*, 12 June 2020; <https://www.nursingtimes.net/opinion/how-can-nurses-help-with-teaching-children-more-effective-handwashing-12-06-2020/>